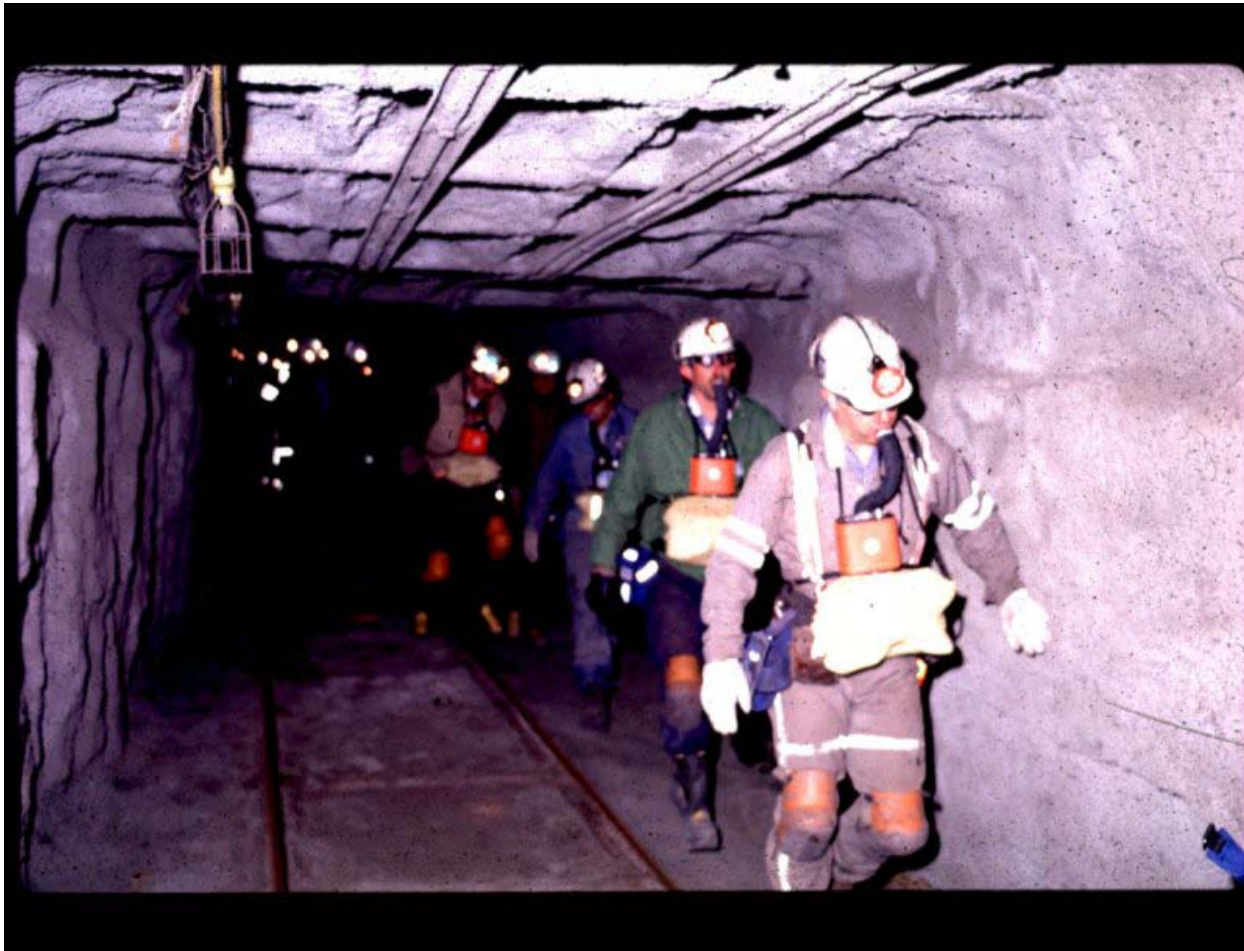


SCSR History

John Kovac, Senior Scientist
National Personal Protection Technology Laboratory
(NPPTL), NIOSH

29 March 2011



No miner should be forced to rely upon an SCSR that might be unsafe for an escape. Just as important, a miner must have confidence that his SCSR will work in an emergency and have the hands-on knowledge of how to use it. Escape means taking miners on foot and under oxygen from the workplace to a point of safety.

SCSR History

- **Pre-1981 miners rely on FSRs**
- **1981 1st generation SCSRs**
 - Joint MSHA/NIOSH Approval (30 CFR 75.1714, 42 CFR 84)
 - Fewer than 40,000 SCSRs in deployment
 - 1 SCSRs/miner
 - Service life: 3 yr worn, 5 yr stored
- **1983 LTFE begins (50 SCSRs/year)**
 - Non-random sample to discover field problems
- **1989 2nd generation SCSRs**
 - Smaller, lighter weight
- **2000 SCSR reliability**
 - MSHA durability study
 - LTFE expands – 200 SCSRs/yr
 - Service life 10 yr
- **2006 MINER ACT**
 - Extra SCSRs deployed
 - MSHA SCSR Inventory
- **2007 Revised LTFE**
 - Random Sample based on MSHA SCSR Inventory
 - 400 SCSRs /year
- **2009 SCSR deployment reaches 187,000**
 - Redundancy = 3 to 4 SCSRs /miner



Lessons Learned From The 25 Year History Of SCSRs

- **Escape under oxygen is the primary survival strategy.**
- **In some cases more than 1 SCSR per miner is needed for escape.**
 - 1 hr SCSR does not mean 1 hr for every miner under every circumstance
 - Actual duration depends upon
 - Miner – body weight , age, physical fitness
 - Difficulty of the escape – distance, escapeway factors
 - Miner's confidence
- **Miner's confidence in SCSRs depends on:**
 - SCSR reliability
 - Hands-on training

Partnerships

- **Stakeholders**
 - BCOA
 - NMA
 - UMWA
 - USWA
 - SCSR manufacturers: CSE, Draeger, MSA, and Ocenco
- **MSHA is co-approver**

MSHA/NIOSH Approved SCSRs

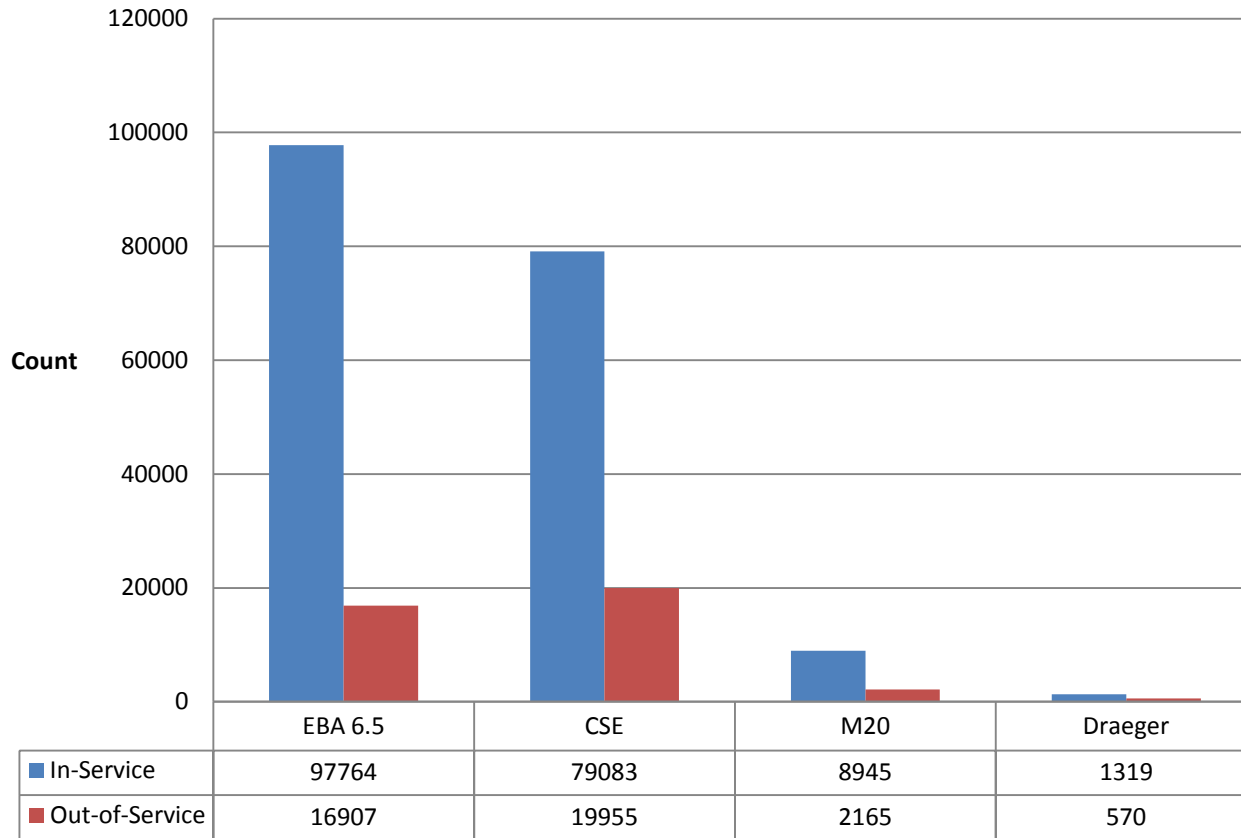


MSHA SCSR Inventory

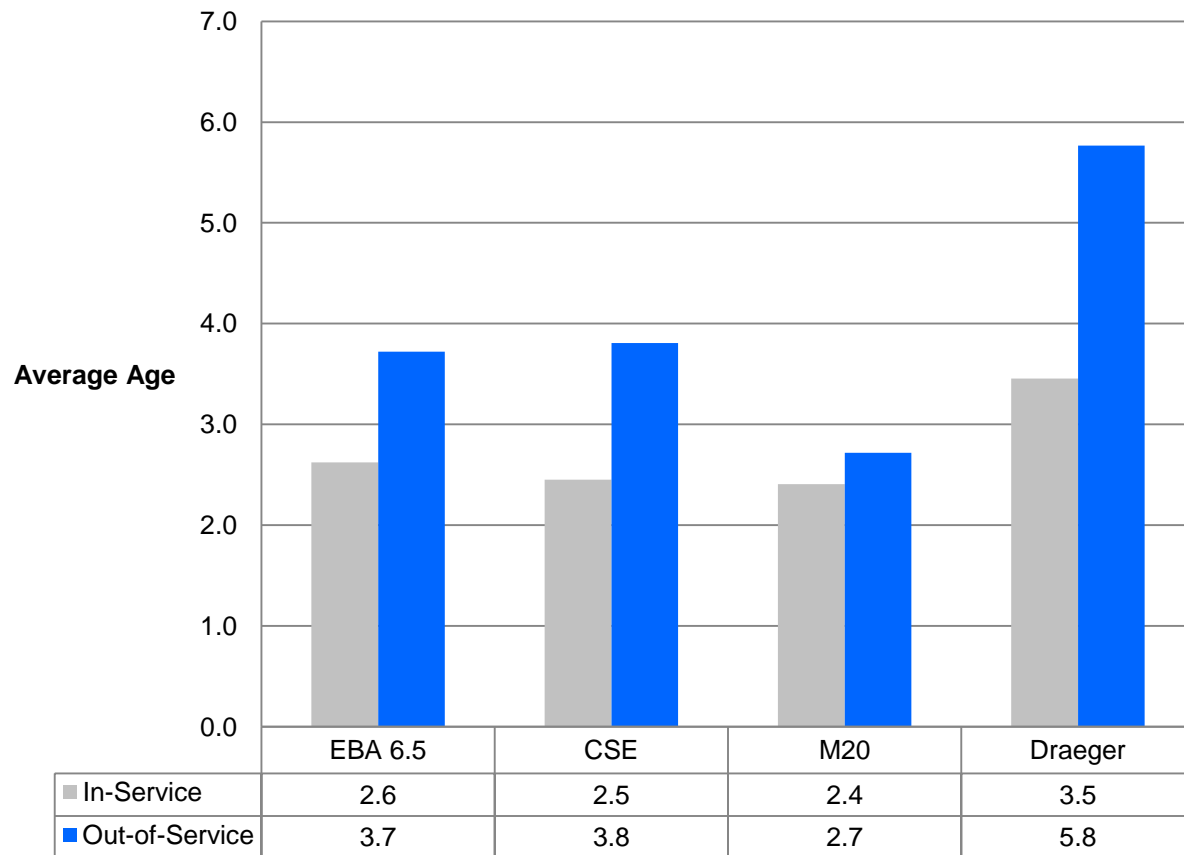
- The SCSR Inventory is required by MSHA's Evacuation Rule which was put in place after the MINER Act
- An accounting of all SCSR's deployed in US underground coal mines
 - Tracks individual SCSRs:
 - Model
 - Serial Number
 - Date of Manufacture
 - Deployment status (In-Service, Out-of Service)
 - Location (Mine ID)
- Mines supply information, which MSHA later enters by hand into the inventory data base
- To date, MSHA SCSR Inventory accounts for :

– In –Service	187,111
– <u>Out-of-Service</u>	<u>39,597</u>
– Total	<u>226,690</u>

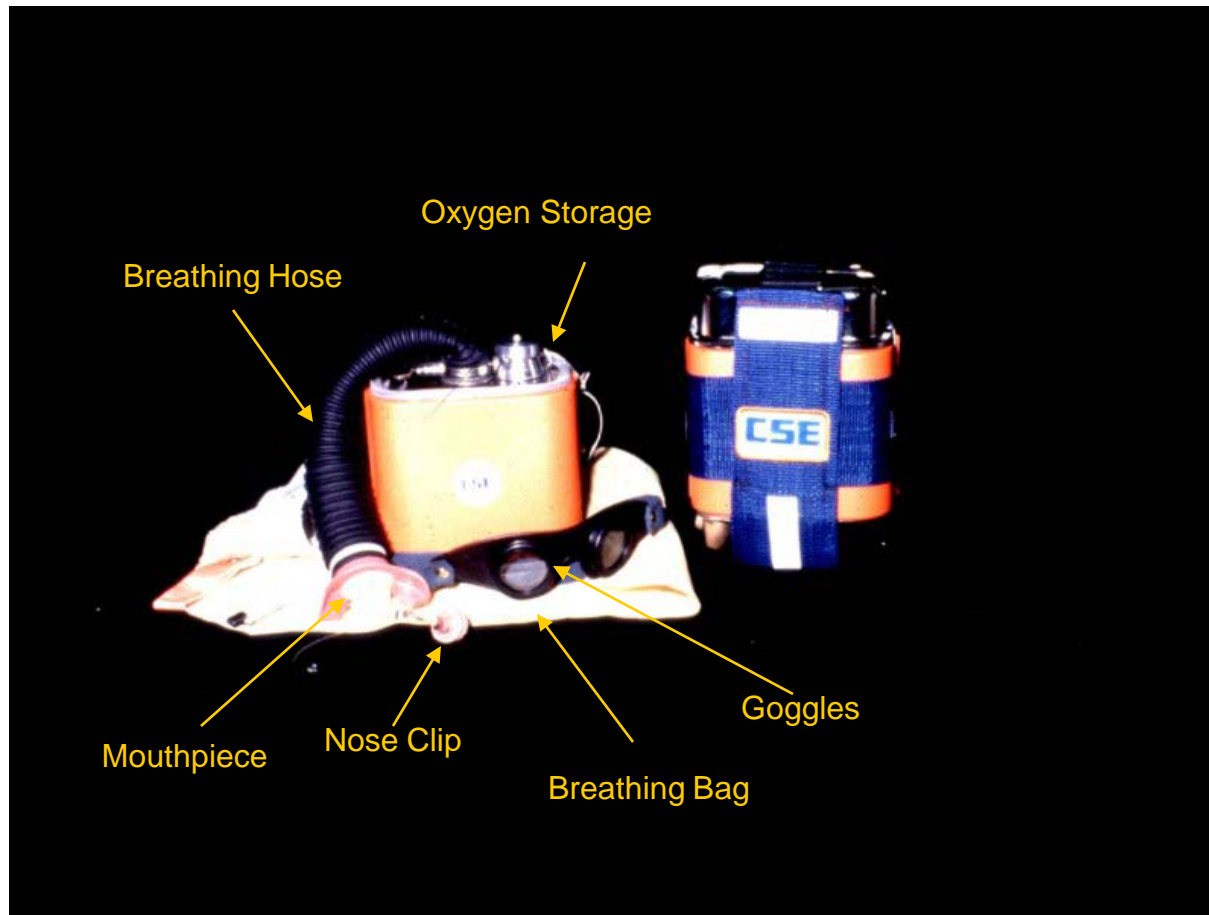
SCSR Distribution: 2010



SCSR Average Age: 2010

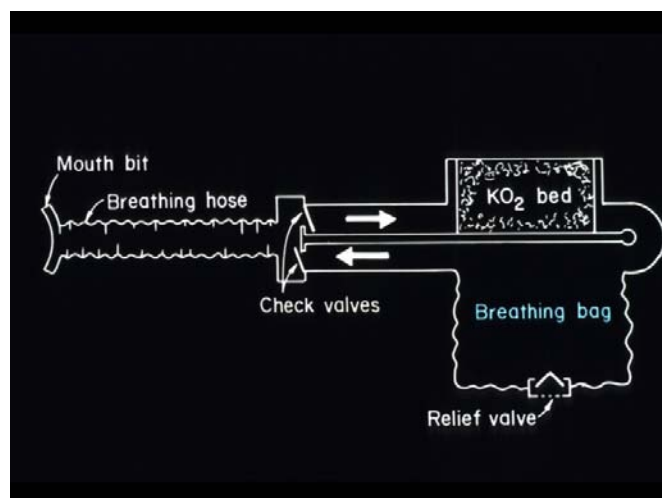


SCSR Components

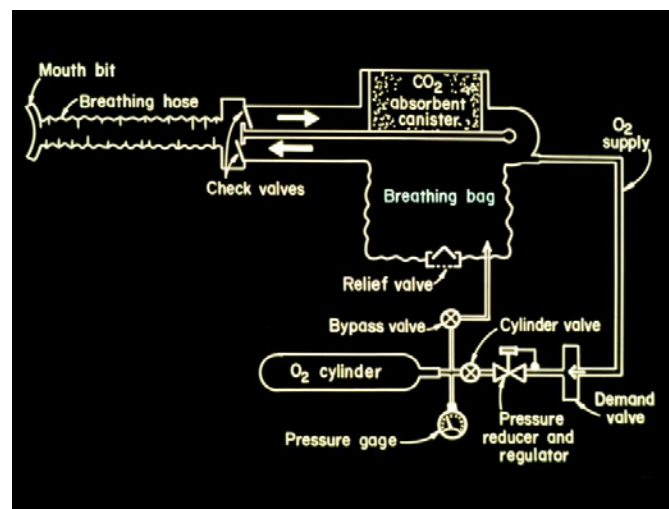


How An SCSR Works

Chemical Oxygen



Compressed Oxygen



New Technology

Innovative and creative technology for:

- Oxygen generation
- Carbon dioxide removal
- Carbon monoxide elimination
- Materials for respirator components
- Materials for storing chemicals and high pressure gasses
- Test technology
- Training methods and materials
- Service and maintenance

Hybrid Self Rescuers

Hybrid Self Rescuer (HSR): Combination SCSR and FSR Respirator

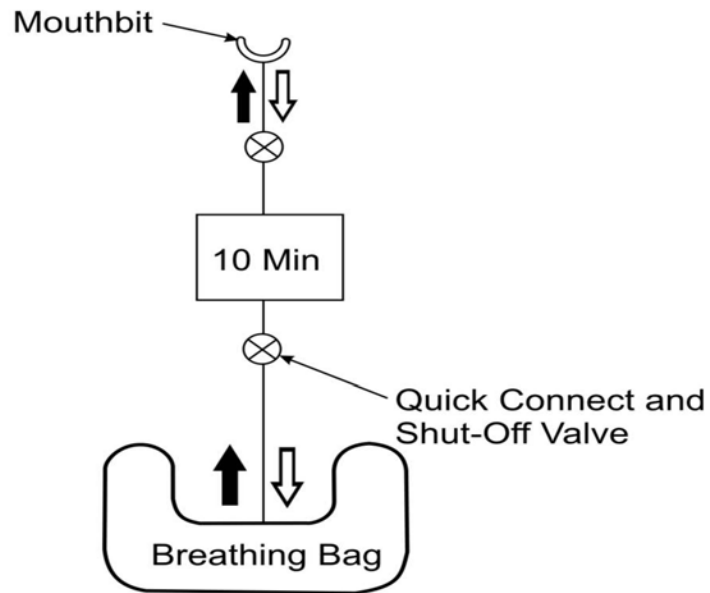
- SCSR
 - O₂ Supply & CO₂ Removal
 - KO₂, Chlorate or Compressed Gas
- FSR
 - Traditional Technology → Hopcalite
 - New Technology → CO Oxidation Catalysts
- Advantages
 - Extended Protective Capacity
- Challenges
 - Sensing CO & O₂
 - Switching → Mode of Operation

Dockable SCSR

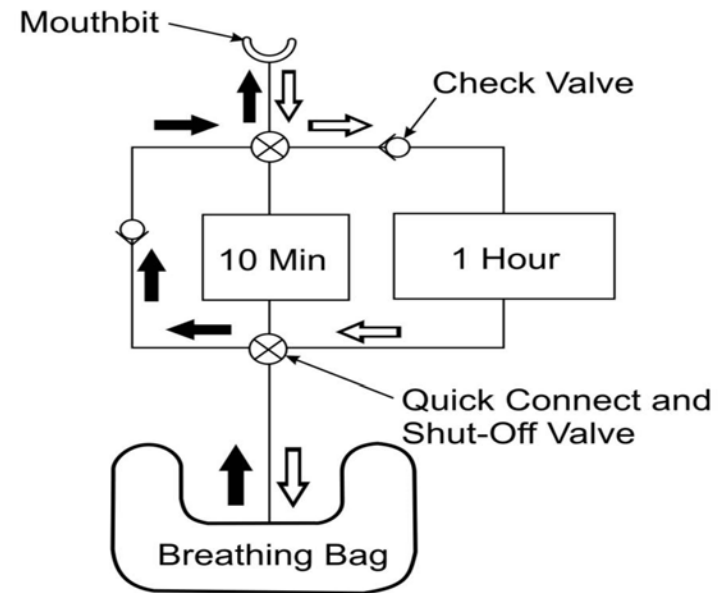
Dockable Short & Long Duration SCSR

- Additional Canisters Coupled to an SCSR
 - Eliminates Multiple Donning
 - Extended Protective Capacity
 - Allows for Smaller, Lighter Carried SCSR
- Prototype Dockable SCSR Developed 30 Years Ago
- This type of unit is allowable under interpretations of current MSHA regulations (30 CFR Part 75.1714) which permits a 10/60 SCSR

Schematic Dockable SCSR



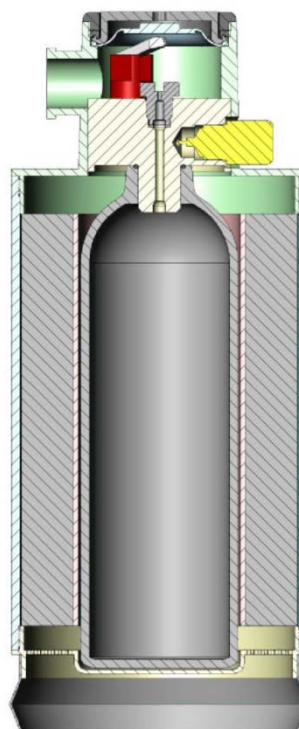
SHORT DURATION SCSR



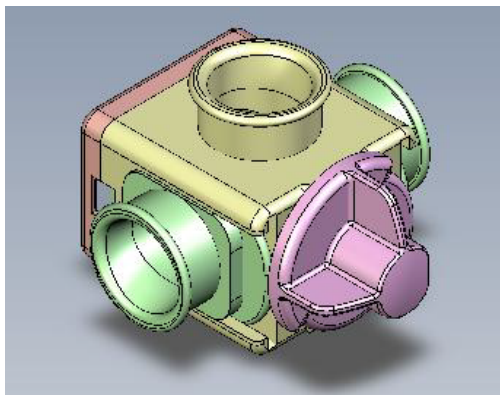
COUPLED SHORT AND
LONG DURATION SCSR

Self Contained Self-Rescuer (SCSR) Plus

- Technical Products, Inc.
- O2 Pendulum Rebreather
- O2 flow demand regulated automatically
- LiOH CO2 Scrubber
- When rebreather is spent SCSR 'docks' to any other breathing air supply
- 1-hr breathing unit
- Weighs 5.7-lb.

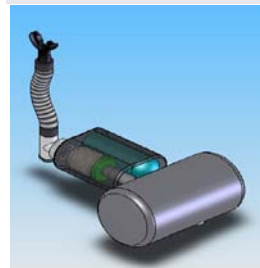
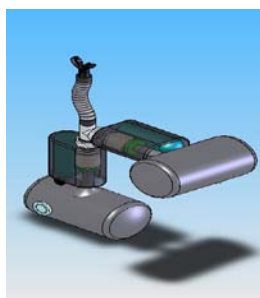
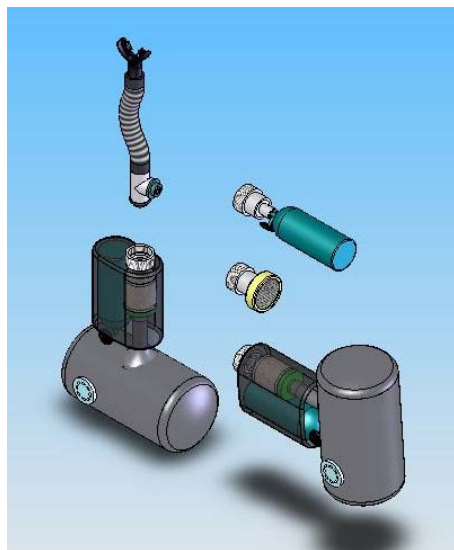


Docking Device



Allows user to change or exchange air supplies without breaking seal

- **Allows selection of air supply in real time**
- **Multiple mechanical safeties**
 - Can't 'select' to vent to atmosphere
 - Can't detach 'live' air supply



Engineered Materials / Systems Design

- **Sealed Foil Pack**
 - Hermetically Sealed Chemicals
 - Exchangeable Packs
- **Superoxide Treatments**
 - Catalytic Coatings
 - Pelletizing
- **Pressure Vessels — Carbon Cylinders**
- **User Interface Concepts — Hoods**
- **Packaging**